

# Design and Analysis of Four Stroke Petrol Engine with Hydrogen Rich as Fuel

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## ABSTRACT

The internal combustion engine has played an important role in the transport industry with outstanding advantages in power generation, although the increasing pressures of fuel use and environmental pollution from these engines are big problem. Moreover, increasingly stringent emissions targets and the rapid depletion of oil resources have prompted researchers to study the use of alternative fuels for IC engines. Hydrogen is one of the best alternatives to traditional fuels. Hydrogen has its benefits and limitations in its use as an alternative fuel in transportation engines. Hydrogen is the most abundant element in the universe and exists mainly as a compound with other elements. Hydrogen has long been viewed as a desirable fuel for internal combustion engines. Unlike fossil fuels, these are non-polluting fuels, renewable and can be produced from endless water. On the other hand, one of the most effective ways to improve combustion efficiency on existing engines without much change in engine structure is to add a small amount of hydrogen gas or hydrogen-rich gas to the engine. This paper briefly presents the outstanding properties of hydrogen fuels that affirm their applicability in internal combustion engines. Furthermore, the evaluation of hydrogen fuel using solutions on IC engines is also presented to clarify the engine characteristics and emissions when using this fuel

**Keywords**—Hydrogen chamber, Electrolysis, IC Engine, Battery

## I. INTRODUCTION

Much of the world's energy comes from material formed hundreds of millions of years ago, and there are environmental consequences for it. Decomposing plants and other organisms, buried beneath layers of sediment and rock, have taken millennia to become the carbon rich deposits we now call fossil fuels. These non-renewable fuels, which include coal, oil, and natural gas, supply about 80 percent of the world's energy. They provide electricity, heat, and transportation, while also feeding the processes that make a huge range of products, from steel to plastics. When fossil fuels are burned, they release carbon dioxide and other greenhouse gases, which in turn trap heat in our atmosphere, making them the primary contributors to global warming and climate change. The two main problem of the internal combustion (IC) engine which contribute negatively in our life. These two problems are emissions, which is related to the environment, and mechanical problems,

which are related to the IC engines themselves. In this project the focus will be on some solutions for these two problems. The exhausts of vehicles, IC engines, are a main source of emissions. Self-ignition can be defined as the situations in which the fuel in a combustion chamber burned automatically without external cause such as a spark plug, and this is caused due to extremely high temperature and pressure inside the chamber. But the fuel inside the combustion chamber will not burn in the proper time, and the combustion cannot be as efficient as it burns in a proper time. Consequently, this problem will have negative effects from both economic and environmental perspectives. This will cause to more emissions with poisonous gas, to reduce it we have come across this idea. As we already know that the fossil fuel on planet earth is coming to an end, everyone is looking for an alternate fuel. Hydrogen is a clean fuel that, when consumed in a fuel cell, produces only water. Hydrogen can be produced from a variety of domestic resources, such as natural gas, nuclear power, biomass, and renewable power like solar and wind. These qualities make it an attractive fuel option for transportation and electricity generation applications. It can be used in cars, in houses, for portable power, and in many more applications.

Hydrogen is an energy carrier that can be used to store, move, and deliver energy produced from other sources. Today, hydrogen fuel can be produced through several methods. The most common methods today are natural gas reforming (a thermal process), and electrolysis. Other methods include solar-driven and biological processes. Thermal processes for hydrogen production typically involve steam reforming, a high-temperature process in which steam reacts with a hydrocarbon fuel to produce hydrogen. Many hydrocarbon fuels can be reformed to produce hydrogen, including natural gas, diesel, renewable liquid fuels, gasified coal, or gasified biomass. Today, about 95% of all hydrogen is produced from steam reforming of natural gas.

The vehicle produces lots of pollution in our environment which is one of the main issues faced by us. To overcome this problem we have selected hydrogen, which reduces the smoke, and even if the unburnt hydrogen comes out it's not a problem for humans or to the environment, Hydrogen will help to increase the efficiency of the engine. Now a day's raise in the rate of fuel is also a main problem faced by people so by reducing the fuel consumption we can save money and also the fuel.

## II. LITERATURE SURVEY

R.Sharavanan, et.al [1] In this paper they discussed about how to obtain the high-efficiency petrol engine by modifying the engine. He has focused on the compression ratio of the petrol engine. By increasing the compression ratio by 9 to 9.58 to achieve high thermal efficiency. The possibility of detonation is minimized by mixing around 5% of anti-knock additives called toluene with the petrol and it has been found that the air standard efficiency of an engine is increased from 58.36% to 59.47% and decrease in pollutants.

H R Reitz et.al[2]In this paper he discusses about affordable energy has been instrumental in raising the standard of living in the world dramatically, particularly in poor countries, and the fact that so far in the history of humanity, the burning of fossil or bio-derived fuels has been the only reliable source of energy, The entire planet is linked by massive transportation which is based on the IC engine so it may take decades to replace it, The advancement in IC engine technology have decreased pollutant level down, The obstacles still faced by proposed alternatives, such as EV powered by batteries, which have tremendous cost, weight and

other limitations and the concerns about the impact of IC engines on climate change have become politically charged.

Zaid Karjekar [3] In this paper discusses the various beneficial properties of hydrogen, its use as a fuel in internal combustion engines, fuel cells, its performance and compares FCEVs with electrical vehicles and the challenges faced in making hydrogen- based vehicles available for the masses thereby giving the reader a thorough idea about the scope of hydrogen-based vehicles.

Stefan Sterlepper et.al [4] In his experiment he used and said hydrogen as carbon-free fuel is a very promising candidate for climate-neutral internal combustion engine operation. In comparison to other renewable fuels, hydrogen does obviously not produce CO<sub>2</sub> emissions. In this work, two concepts of hydrogen internal combustion engines (H<sub>2</sub> -ICEs) are investigated experimentally, while H<sub>2</sub> -ICEs present new challenges for the development of the exhaust gas after treatment systems, they are capable to realize zero-impact tailpipe emission operation.

ZbigniewStepien [5]This paper provides a comprehensive review and critical analysis of the latest research results in addition to an overview of the future challenges and opportunities regarding the use of hydrogen to power internal combustion engines (ICEs).

M. Faizal, et.al [6]In this paper they discussed about the non- renewable sources of energy are being depleted at an exponential rate. Thus, alternative sources of fuel have become more important to prevent the occurrence of an energy crisis. Seeing that hydrogen is not a source of energy but rather, a carrier of energy, Various methods of producing, storing and transporting hydrogen have been discovered to accommodate the demands for hydrogen, making it as easily accessible as petroleum but not as environmentally harmful. The hydrogen market is a nice market that is slowly gaining popularity, proving that hydrogen fuels will be the next big wave.

Ho Lung Yip, et.al [7] In this paper they discussed about a paradigm shift towards the utilization of carbon-neutral and low emission in the internal combustion engine industry to fulfil the carbon emission goals .Hydrogen as an energy carrier and main fuel is a promising option due to its carbon-free content, wide flammability limits and fast flame speeds. For spark-ignited internal combustion engines, utilizing hydrogen direct injection has been proven to achieve high engine power output and efficiency with low emissions.

Frantisek Synak, et.al [8]In this paper they discussed about road transport has a significant effect on air pollution. So in this they focuses on the impact of addition of “oxyhydrogen”, known as HHO, on selected vehicle features. These features, on which this study is focused, include the engine power and torque, composition of the exhaust gases and fuel consumption. There was also an impact of HHO on the value of pre-ignition as well as engine cleaning observed.

FuratDawood et.al [9] In this paper they discussed about Power to hydrogen is a promising solution for storing variable Renewable Energy (RE) to achieve a 100% renewable and sustainable hydrogen economy. The hydrogen-based energy system comprises four main stages. The hydrogen production pathway and specific technology selection are dependent on the type of energy and feedstock available as well as the end-use purity required. Hence, purification technologies are included in the production pathways. Despite hydrogen being zero-carbon-emission energy at the end-use point, it depends on the cleanness of the production pathway and the energy used to produce it.

Shan Wang, et.al [10]In this paper they discussed about water splitting electrolysis is a promising pathway to achieve the efficient hydrogen production in terms of energy conversion and storage in which catalysis or electro catalysis plays a critical role.

Akal D, et.al [11]In this paper they said hydrogen is an alternative fuel with high efficiency and superior properties. The development of hydrogen-powered vehicles in the transport sector is expected to reduce fuel consumption and air pollution from exhaust emissions. In this study, the use of hydrogen as a fuel in vehicles and the current experimental studies in the literature are examined and the results of using hydrogen as an additional fuel are investigated.

Van Tam Bui, et.al [12]In this paper they discussed about the internal combustion engine has played an important role in the transport and industry. Hydrogen is one of the best alternatives to traditional fuels, Hydrogen has its benefits and limitations in its use as an alternative fuel in transportation engines. Hydrogen is the most abundant element in the universe and exists mainly as a compound with other elements. Unlike fossil fuels, these are non-polluting fuels, renewable and can be produced from endless water.

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ShahramAmiri, et.al [15] In this paper they discussed about hydrogen is an important and environmentally friendly energy source and the need for its usage is growing across the world. Water-Gas Shift (WGS) reaction is the key approach for hydrogen production which uses different catalysts with respect to conditions at which the reaction occurs. This research examines the applicability of a machine learning technique called Least Square Support Vector Machine (LSSVM) to predict the conversion of carbon monoxide in WGS reactions according to various compositions for active phase and different kinds of support compounds for catalysts. The implemented method considers the intrinsic catalyst variables to predict the performance of the reaction by using variables such as surface area, calcinations time and temperature

### III. METHODOLOGY

In this work we use four stroke petrol engines as our working engine, and supply a renewable energy source to the engine. The main goal of this project is to reduce the fuel consumption and reduce the emission and to

make eco-friendly and economic. In this project we use certain process to produce hydraulics process to produce the hydrogen. Here we use water as a base source to produce hydrogen by electrolyses process; after we produce hydrogen, we then directly supply hydrogen to the carburettor of the engine. The hydrogen then passes with the fuel to the combustion chamber of the engine, with the help of hydrogen the combustion process in the combustion chamber will take place very smoothly and it will also reduce the emission of the engine. It will also reduce the fuel consumption of the engine.

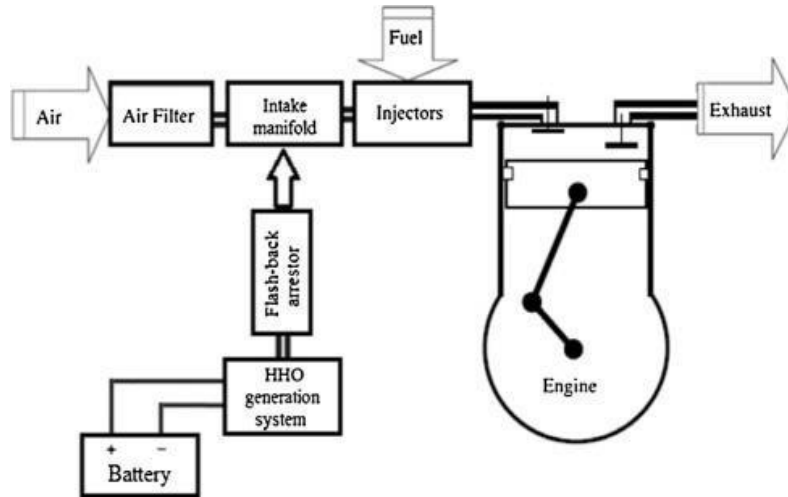


FIG : BLOCK DIAGRAM

#### IV. COMPONENTS USED

The various components used for the construction of our model is shown below.

- BATTERY
- CARBURETOR
- IC ENGINE
- FUEL TANK
- HYDROGEN CHAMBER
- ELECTROLYSIS

#### V. APPLICATION

Automobile vehicles such as bike, car, scooter, also this can be used in various industries for efficiency purpose and pollute free nature.

#### VI. RESULTS

The overall result of hydrogen in IC Engine can create more efficient efficiency engine and pollute free tail pipe, by using this hydrogen engine we can create a eco friendly nature which can result a better tomorrow in automobile field.

TABLE : POLLUTION TEST RESULT

INITIAL	PRES STD	MEASURED LEVEL
CO	3.5	01.854
HC	4500	3892
CO2		00.80
O2		14.37

FINAL	PRES STD	MEASURED LEVEL
CO	3.5	01.545
HC	4500	3243
CO2		00.69
O2		13.85

## VII. CONCLUSION AND FUTURE SCOPE

Hydrogen gas has a very small density, the energy density per unit volume is very small, so it is used in an internal combustion engine, it is necessary to compress to very high pressure or be liquefied. One simple solution to use hydrogen gas or a mixture of hydrogen-rich gas for an internal combustion engine is to supply a small amount of hydrogen gas or a mixture of hydrogen-rich gas into the engine intake manifold or the engine cylinder. Hydrogen in this case acts as a fuel additive or a catalyst to promote combustion more thoroughly. The effect of adding hydrogen to the intake manifold of a compressed combustion engine is significantly reduced in the emission components of HC, CO, CO<sub>2</sub>, PM and soot. However, the NO<sub>x</sub> content increases with the addition of hydrogen, but this problem can be controlled with solutions such as spray strategy, using EGR systems, spraying water vapour onto cylinder walls as well as using post-generation remedies. The efficiency of diesel-hydrogen dual-fuel engines with different hydrogen injection systems found that the solution of hydrogen injection into the intake manifold was better and reduced emissions components compared to the technology that provides hydrogen by the carburettor and sprayed into the intake manifold. 1) for big scale implementation, RO and UV water filter may be used for manufacturing such water that meets the standard of WHO and BIS simply. 2) Peltier device has many varieties of models that are much efficient than TEC1. Those may be used. 3) The conception of this project can even be used as a far better alternative in refrigeration science against typical systems. It can even be determined during this method i.e. the usage of such low power semiconductor devices are indicating towards additional outstanding evolution of cooling engineering that's attending to alter the entire situation and myths regarding the ability consumption of refrigeration science. therefore, in close to future we'll be able to use such devices that are currently restricted inside the project works.

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